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Threats to the Integrity of Science

Peter H. Gleick, PhD
President, Pacific Institute
MacArthur Fellow
Member, U.S. National Academy of Science.
pgleick@pacinst.org [510 251-1600]

Senators, thank you for the opportunity to provide testimony today on the critical issue of the integrity of science. Good, independent science – indeed, good information in general – is crucial to making good political decisions. It is difficult enough to make intelligent policy choices given the complexities of today's political, environmental, economic, and social challenges. It is almost impossible when good science or data are ignored or distorted, or when bad science is sought out, to support pre-determined political conclusions. Yet never have the political abuses and misuses of science seemed as pervasive and intentional as they have over the past few years.

The United States has a long and proud non-partisan tradition of scientific research, analysis, and support. As far back as the American Revolution, Benjamin Franklin embodied the ideal of integrating a passion for science and fact with diplomacy and politics. This tradition continued through more than two centuries of advances in both science and in the tools and avenues for moving scientific information into the policy arena. By the end of the 20th century, institutions like the White House Office of Science and Technology Policy (OSTP), the President's Science Advisor, the Office of Technology Assessment (OTA), the National Academies of Sciences and Engineering (NAS and NAE), national laboratories and universities, and even the media, were considered vital, independent sources of information, fact, and analysis needed across the political spectrum for making smart policies.

For the last several years, there have been growing indications of systematic challenges and threats at the federal level to the integrity of the scientific process using a variety of strategies and tactics. Independent government review organizations and advisory boards have been disbanded. Access to data and information has been reduced. Federal scientists have been muzzled. Scientific reputations, rather than scientific evidence itself, have been questioned. Scientific analyses and conclusions, prepared within federal agencies or by people outside of government, have been changed for political and ideological reasons by people who have not done the scientific work. Work by partisan organizations has been substituted for work by non-partisan scientists.

The Pacific Institute and its **Integrity of Science** program[1] has been cataloging and evaluating threats in the areas of environmental problems, energy policy, human health, and national security. My testimony today will offer a framework (see **Table 1**, below) for better understanding and categorizing these threats. I also offer a few specific examples and cases that may offer some insights into how Congress might act to once again support the use of science in informing and setting policy.

Scientific Misconduct and Altering Good Science

Policy makers have the right to make decisions that consider, but then discount, good science. Science is, after all, only one factor among many that must be weighed in making policy. But they have no right to seek bad science to support predetermined conclusions, to misrepresent, misquote, misuse, or suppress science that contradicts those conclusions, or to penalize scientists who seek to inform and educate the public.

Equally important, political operatives and appointees must not be permitted to alter scientific findings and edit scientific conclusions to support pre-determined outcomes, as has recently been reported in the fields of climate change, the health effects of pollution, and the need to protect threatened animals and plants under the Endangered Species Act.

Suppressing or Limiting Good Science

Access to information is a cornerstone of good policy. Efforts by outside parties, or federal agencies, to restrict or limit access to information are particularly damaging in a democratic society. These efforts take different forms. Access to good science can be limited through changes in funding to selectively collect, fail to collect, or reduce access to certain kinds of data. Recent changes in funding have reduced the ability of the United States to collect data on environmental issues, to analyze data that are collected, and to disseminate information to the public. For example, the decision to close Environmental Protection Agency libraries in major cities (such as Washington, Chicago, Dallas, and Kansas City) would cut the availability of scientific information, data, and reports available to the public. Funding cuts for satellite instrumentation to monitor the Earth's climate will hinder the development of intelligent climate policy.

Scientific Policy Misconduct

Ensuring that science is made available to policy makers has long been a challenge. In recent years, however, certain actions have made it more difficult for independent, non-partisan science to reach Congress and decision makers. The loss of the Office of Technology Assessment has crippled Congress's ability to analyze information, receive independent advice, and make thoughtful decisions on vital technological questions.

The recent disbanding of a wide range of independent advisory committees, or efforts to pack them with ideological allies, weakens the policy process. For example, the Secretary of Health and Human Services (DHHS) disbanded the National Human Research Protections Advisory Committee and DHHS's Advisory Committee on Genetic Testing. Fifteen of the 18 members of the Advisory Committee to the Director of the National

[1] The Pacific Institute, founded in 1987, is an independent, non-partisan policy research center. For details, see www.pacinst.org.

Center for Environmental Health (NCEH) were replaced, many with scientists with stronger ties to industries that may be regulated or in leadership positions of organizations opposed to public health and environmental regulation.[2]

The U.S. Department of Energy's principal outside advisory board on scientific and technical matters, in place for more than a quarter century, was recently disbanded. The independent committee set up by Congress to advise the government on the safety of the nation's nuclear weapons stockpile has been eliminated.[3] The Secretary of Health and Human Services disbanded advisory committees that provided oversight on genetic testing and the use of humans in research. A nominee to the Army Science Board was rejected by the current Administration because he was thought (incorrectly it turns out) to have contributed to the presidential campaign of another Republican candidate for President. All of these actions have the effect of reducing the quantity and quality of independent scientific advice that reaches decision makers.

Arguments from Ideology

There is, unfortunately, a long history of policy arguments made from ideological or religious perspectives that result in attempts to discredit contradictory scientific information. The classic example, of course, is the order that Galileo Galilei, the famous Italian physicist, astronomer, and philosopher, stand trial on suspicion of heresy in 1633. The charges stemmed from Galileo's research and writings that supported the idea that the Earth moved around the sun, rather than the understanding of the time that the Earth was fixed in the heavens, derived from literal readings of the Bible. The idea that the Sun was stationary was condemned as "formally heretical" and Galileo was required to recant his ideas, subjected to house arrest for the remainder of his life, and had all his publications banned. As Galileo said: "I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use."

More recently, biology in the Soviet Union during the 1930s and later periods was crippled when control and direction of state research was given to T.D. Lysenko who rejected the science of genetics for ideological reasons. Between 1934 and 1940, under Lysenko's admonitions and with the approval of Stalin, many geneticists were executed or sent to labor camps.

In the United States, ideological arguments that lead to the rejection of scientific information and conclusions, and contribute to public confusion and policy disarray, are still seen in disputes over evolution, climate change, sex education, and various health research efforts, such as stem cells. The inability to believe or accept something because of ideological or religious contradictions says nothing about the accuracy or truth of scientific findings.

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[2] Michaels, D. et al. 2002. "Advice Without Dissent." Editorial. Science, Volume 298, No. 5594, p. 703, October 25, 2002.

[3] J. Dawson, "Disbanding NNSA Advisory Panel Raises Concerns," Physics Today, September 2003

Ad Hominem; Personal Attacks

An unusual and disturbing trend can be seen in efforts to discredit scientists on personal grounds, rather than on challenges to science. Such personal attacks have no place in public discourse. In the world of political spin and hypocrisy, we've also seen pundits attempt to paint all scientists as ideologues who twist their science to fit preconceived political preferences.[4] Scientists make errors; indeed some let ideology trump evidence. But these scientists cannot long escape the proper functioning of the scientific process. Fraud, abuse, and error are found out, revealed, and discredited.

Scientists, including this witness, have been threatened with lawsuits for offering public opinions on controversial issues to reporters.[5] But there is a difference between scientists who distort their work and produce bad science based on pre-conceived political positions, and scientists who are willing to share peer-reviewed results with the public and policy makers. The former are fortunately rare and almost always discovered and discredited by the normal scientific process; the latter are not common enough and they should be encouraged, not discouraged.

Blanket attempts to discredit good science and scientists who attempt to inform the public and policy makers must be challenged. Similarly, officials who open "investigations" of scientist who reach conclusions that differ from their own do a disservice to science, unless there is evidence of wrongdoing.

Misuse of Uncertainty and Arguments from Consensus

Finally, there is a serious misunderstanding among some policy makers of the nature of scientific certainty and knowledge, and a corresponding misuse of uncertainty. Absolute certainty in science, or even in politics, is a rare luxury, and never guaranteed. Insisting that scientists provide certainty before setting vital public policy is a recipe for inaction and delay. As Dr. Stephen Jay Gould said, "In science, 'fact' can only mean 'confirmed to such a degree that it would be perverse to withhold provisional assent.' I suppose that apples might start to rise tomorrow, but the possibility does not merit equal time in physics classrooms." Yet political strategists often publicly recommend using uncertainty to delay actions long past the time when scientists believe we know enough to act.[6] The issue of climate change is an example of this, where the misuse of uncertainty has delayed national action long past the time when effective policies were needed.

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[4] See, for example, P. Noonan, "The Heat is On." Wall Street Journal, July 20, 2006.

[5] See "Science, Climate Change, and Censorship: The Pacific Institute, Patrick Michaels, and Climate Change. http://www.pacinst.org/press_center/censorship/.

[6] See, for example, the call to make scientific uncertainty a key part of the climate debate by Luntz Research Companies. 2002. "The Environment: A Cleaner, Healthier, and Safer America." Memorandum for GOP Congressional Candidates. p.137. http://www.ewg.org/briefings/luntzmemo/pdf/LuntzResearch_environment.pdf. See also the statement by the Tobacco Institute of Hong Kong, "The view that smoking causes specific diseases remains an opinion or a judgement, and not an established scientific fact." Tobacco Institute of Hong Kong Limited, 1989, March.

Similarly, there is confusion all along the political spectrum on the issue of "consensus" in science. A "consensus" among scientists does not make an issue true or false. It is a reflection of the best scientific understanding at the time. For example, an argument is often made in the context of global climate change that very large numbers of climate scientists believe in climate change; therefore it must be a serious problem. This is backwards: climate change is a serious problem because of the mass of scientific evidence that underlies those beliefs, and it is that evidence that produces the consensus of opinion. The strength of the argument comes from the science itself, not the consensus.

Summary

In the long run, the truth of whether the earth is round (mostly), goes around the sun (so the best evidence shows), or is warming due to industrial activity (considered "very likely" i.e., more than 90% certainty) will be demonstrated on the global stage. Our job as scientists is to seek the best understanding of the world around us and to communicate that understanding to the public. Your job as elected officials is to encourage scientists to give you their best understanding, fund new science if there are gaps vital for the public interest, to weigh scientific information, and then to make decisions. Short-term political or economic advantage must be trumped by our collective responsibilities to protect public health, the environment, and our national security and to ensure that our decisions are informed by the best available information.

Specific Recommendations

Congress can act to help restore confidence in the integrity of science and to reduce threats to science and scientists working to advise policy makers and the public:

- Reinstate independent advisory committees to Congress and to federal agencies.
- Require that no political litmus tests be imposed on advisory committee appointees.
- Guarantee open public access to government studies, data, and scientific findings.
- Require transparency of information on conflicts of interest.
- Prohibit federal agencies and employees from modifying, censoring, or altering scientific findings.
- Re-establish and adequately fund an independent advisory organization to Congress on technology and science issues.

Thank you for the opportunity to present this testimony to you, and for entering it in the Record.

[Table 1, attached below]

Table 1
Categories of
Deceitful Tactics and Abuse of the Scientific Process
(source: P.H. Gleick, Pacific Institute, 2007)

There are many tactics used to argue for or against scientific conclusions that are inappropriate, involve deceit, or directly abuse the scientific process.

Appeal to Emotion
This is a large category and involves using various tactics to incite emotions in people in order to persuade them that a particular argument or hypothesis is true or false, independent of the scientific evidence.

Appeal to Fear
Appeal to Flattery
Appeal to Pity
Appeal to Ridicule
Appeal to Spite

Personal ("Ad Hominem") Attacks
This approach uses attacks against the character, circumstances, or motives of a person in order to discredit their argument or claim, independent of the scientific evidence.

Demonization
Guilt by Association
Challenge to Motive (such as greed or funding)

Mischaracterizations of an Argument
This approach typically mischaracterizes an issue or evidence and then argues against the mischaracterization. It can include.

Begging the Question
Circular Reasoning
Partial Truths
Selective Choice of Problems
Straw Man Argument (includes substituting a distorted, exaggerated, or misrepresented position for the one being argued
Loaded Question (includes posing a question with an implied position that the opponent does not have.)
False Dichotomy (for or against)/False dilemma (includes assuming that there are only two possible opinions or choices.)
Misplaced Burden of Proof
Confusing Cause and Effect
Red Herring (includes presentation of an irrelevant topic to divert attention from another topic.
Slippery Slope (includes the assertion that one event must inevitably follow from another)

Inappropriate Generalization
Accusing all of a group of people or arguments or set of facts as having the characteristics of a subset of that group.

Misuse of Facts
- **Numerical Mischaracterization**
- **Selective Choice or Presentation of Data; Biased Sample**
- **Inadequate Sample; Hasty Generalization; Leaping to a Conclusion**
- **Selective Omissions of Data**
- **Illusory Precision** (where precision isn't needed or available)
- **Inappropriate Vagueness** (where precision is needed)
- **Unrelated Facts** (bringing unrelated facts that seem to support a conclusion)

Misuse of Uncertainty
- **Misplaced Certainty**
- **Misrepresentation of Uncertainty**

False Authority
Including appeal to authority not competent to address issue

Hidden Value Judgments
Including judgments based on ideological or religious rationales rather than reviewable and testable evidence.

Scientific Misconduct
The violation of the standard codes of scholarly conduct and ethical behavior in professional scientific research, including:
- **Fabrication** (the fabrication of research data and observations)
- **Falsification** (manipulation of research data and processes or omitting critical data or results)
- **Failure to Acknowledge and Correct Errors**

Science Policy Misconduct
The manipulation of the process of integrating science and policy, including:
- **Packing Advisory Boards**
- **Imposing Litmus Tests**
- **Altering or Suppressing Information**
- **Bullying of Scientists**
- **Selective Funding or De-funding**

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